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PROGRESS IN HORTICULTURAL SCIENCE[1]

By Professor ARTHUR J. HEINICKE

CORNELL UNIVERSITY

THE American Society for Horticultural Science was organized some thirty-four years ago "more fully to establish horticulture on a scientific basis." At that time, the importance of scientific features in our profession was not so generally recognized, and there existed a definite need for stimulating activity in scientific research in the field of horticulture. The founders of our society entertained the hope that the technical papers presented at the meetings would be subject to close scrutiny, and they suggested, diplomatically, that this "would doubtless lead to a more complete investigation of some points imperfectly developed."

All of us will agree, I am sure, that some progress has been made during the third of a century of our existence, in realizing at least in part these objectives of our organization. The records of our annual proceedings give abundant evidence of this. There you will also find periodic summaries of the accomplishments in special phases of horticulture.

By focusing attention on the scientific features of problems in our field, the American Society for Horticultural Science has undoubtedly helped to bring about a general and sympathetic understanding of the need for more complete and well-rounded investigation in all phases of plant science. We especially welcome the attention given by the botanical and physiological societies to our field. Naturally, we hope that they will continue to help us in our endeavor "more fully to establish horticulture on a scientific basis" by using horticultural material whenever it proves suitable in the study of fundamental problems. But above all, we must continue to look to them for the painstaking and diligent research needed for the discovery of an increasing number of fundamental facts of plant life in general. No one realizes more than does the horticulturist, who must deal intimately and effectively with

[1] Presidential address, American Society for Horticultural Science, Indianapolis, Ind., December 29, 1937.

plants, how numerous are the gaps and how narrow and insecure the bases of many of our so-called principles of plant life. We are, therefore, naturally interested in the continuance of truly comprehensive, thorough and painstaking scientific work in supporting fields, regardless of its immediate economic bearing.

It is a source of pleasure to be able to record that the various horticultural industries and the public with whom we are in close contact have come more and more to appreciate our efforts in helping to throw light on their problems. They now confidently look to the professional horticulturists represented in this society to furnish scientific guidance in the solution of many of their practical difficulties.

The purpose in thus calling attention to the status achieved by our society during the past thirty-four years is to emphasize the fact that this imposes an increasing responsibility for progress on the present and prospective membership.

That there will be need for further progress in horticultural science is almost self-evident. With a larger population having higher standards of living and more leisure time for the enjoyment of luxuries and semi-luxuries, we may expect a greater interest in amateur horticulture and a larger demand for the products of horticultural enterprises. This will naturally call for more dependable and more intimate knowledge regarding the plants in our special field. To supply this increasing need is the object of horticultural science, which, with botany as its broad base, concerns itself especially with the life history, response and improvement of that limited group of plants intensively cultivated and grown primarily for the purpose of providing something more than bread alone to nourish the body and otherwise to enrich the lives of mankind by helping to satisfy the longing for beauty.

Many of the research projects in our field frankly aim to solve, or at least to throw light on specific and pressing problems concerning culture, storage or utilization of some particular crop growing in a particular locality. The horticultural scientist, however, does not hesitate, at the same time, to seek knowledge of the fundamental nature and processes of the plants he deals with. In doing so he is aware of the fact that our science is still young and that the small fragment of truth he may contribute will probably not affect present practices materially. He nevertheless has an abiding faith that an increasing store of well-organized knowledge will in due course of time be definitely useful in providing a more rational explanation for many plant responses or in helping to solve practical problems not yet formulated.

In thus dealing with plant life, the horticultural scientist remains conscious of the fact that his studies are directly concerned with the means that contribute to the health, the enjoyment and the economic well-being of a large part of our population. He recognizes that science may properly be interested in questions that seem far removed from immediate practical concern, but he is convinced that scientific methods may also be used effectively in dealing with matters that touch our daily lives. Such contact with practical affairs is by no means inimical to scientific work in the field of horticulture. On the other hand, it does provide frequent opportunity to demonstrate, outside the laboratory walls, the usefulness of the scientific attitude of mind, regarded by many as the most important mental acquisition of man, whatever his vocation may be.

The complexity of the problems with which the horticultural scientist must concern himself and the fact that he is thrown in close contact with those who on the average are probably better informed about the nature of their affairs than almost any other group of practical men, tends naturally to preclude a smug complacency. Without any thought of disparaging what has been done, we can not be satisfied merely to maintain the level of past accomplishments, but we continually seek to raise the standard of excellence in our profession.

Whatever the standards of this society are to be will be determined, not by strict rules and regulations nor by a rigid censorship imposed by autocratic authority, but by the individual scientist himself. Each, recognizing the obligation to advance the ideals of our profession, must discover his own limitations and find the proper remedies for his case. It is pertinent, therefore, to inquire what we as individuals can do to increase the quality along with the quantity of our own contributions.

To put ourselves in the proper frame of mind for such critical self-examination, we need only to remember that, while the methods of science are the best yet devised for solving the riddles of nature with which we in horticulture are concerned, such methods must be applied by scientists who, after all, are only human beings, subject to the limitations and fallacies of human nature in general. Unfortunately, not all human weaknesses have been entirely eliminated as yet by either science or scholarship.

The fact that science has learned from experience the very great difficulty of finding and recognizing the truth, and the extreme likelihood of error (Mulliken, SCIENCE, 86, No. 2221, 1937) should engender due modesty and humility as to the perfection of one's own contributions and opinions. "Untroubled certainty and assured consistency" may be vouchsafed only to those who are not wholeheartedly committed to the

scientific attitude of mind in the solution of their problems.

Among the questions that we may ask in humble and searching self-criticism, none are probably more important than those involved in a relentless scrutiny of our own work. I shall suggest only a few questions applicable specifically to the field of horticulture but more or less familiar to scientists in general, leaving it to your own initiative to extend the list and to supply the answers.

First of all do we fail to recognize the futility of being too impatient in arriving at a solution of a broad problem, or do we realize that it may be impossible as yet to reach a full understanding of all the questions involved? Have we resolved the subject of our inquiry so that it falls within the scope of our present abilities and the facilities of time and equipment required for a thorough investigation, or do we, perhaps, show the profoundest ignorance of the difficulty of the problem by attempting to encompass the entire field?

Are we always fully informed regarding the previous endeavors to solve the particular problem we have laid out for ourselves, or do we continue to thrash over old straw without much hope of finding really new kernels of truth? Have the methods we use in the laboratory as well as in the field frequently been tried out and found wanting as real means of giving us deeper insight into the problem? Do we keep up with the accomplishments of our own generation and are we fully aware of the trend of thought and discovery of new methods of approach in related as well as in our own fields? The fact that this becomes increasingly difficult is obvious, and it is equally obvious that it calls for more energy and industry on our part.

Are we too easily satisfied with incomplete observation and meager data? Are we sure that the observations are really valid for a given complex of conditions, and what do we actually know about the likelihood of obtaining similar responses in another season or during a period of years, or in another location?

Do we take too much for granted when we conveniently assume that except for the experimental treatment, all other conditions are uniform in field trials, or do we provide for frequent replications with numerous checks? In our chemical analyses are we satisfied when the duplicate determinations of a given sample check, or do we insist that there be careful analyses of many separate samples from different lots, so as to give some notion as to the range of variability within our material? Do we really understand the limitations as well as the possibilities in the application of the more modern tools of research, or do we perhaps use them merely to accumulate data and then try to find a reason why we should have taken all the trouble to get them?

Do we too frequently accept statements of others without inquiring into their foundation? Are we content merely to cite the author's own interpretation of his data, or do we evaluate the contribution as to completeness and validity of conclusions? Do we give too eager and perhaps unthinking credulity to so-called authorities, or do we question even them and reserve judgment until we are satisfied that nature in one of her whimsical moods has not put something over on the experts?

In our eagerness to snatch up new ideas and make use of the latest vogue of scientific interest, do we exercise great caution in testing them under a wide range of conditions before we definitely accept their implications? On the other hand, do we find difficulty in discarding hypotheses which we may have learned in our undergraduate days and which may still pass as verities in standard texts when they no longer serve to interpret the responses in the light of newer knowledge?

In reporting our results we may well look more critically toward the use of words to make sure that the meaning has been conveyed clearly and interestingly, but with due regard to the difficulties of expressing truth always smoothly and beautifully. In the preface to his book on North American orchards, Professor Chandler tells us that "truthful writing . . . must be as obscure as the facts are." By omitting all doubts and many qualifying expressions and frequent references to exceptions and limitations of our knowledge, a more convincing presentation could probably be made so far as the general reader is concerned. But the object of a scientific report "is not so much to convince as to cultivate critical analysis of the facts presented, and to stimulate further search for validity."

Is our presentation perhaps too simple, does it sound too sane, too true, or too eminently sensible and logical to fit in with the limitations of the actual facts in the case? Of course, we must inquire as to whether we have thoroughly sifted our facts and fancies and related them to some recognized even though tentative order of knowledge. Have we properly boiled down our material to the essentials, or do we confront the reader with "an appalling mass of material that is likely to bewilder him by its luxuriance and variety, but not to impress him overly much with system and synthesis"? As time goes on we will probably have to learn more and more to be content not to burden the records with all the minutiae of our many unfruitful trials and failures which may have aided greatly in our personal development, but which do not add

much to the store of well-ordered horticultural knowledge in general.

If we are striving for a more uniformly perfect record in the carefully cultivated gardens of horticultural science, we may have to rogue our promising selections of ideas and theories to free them from the hidden virus of wishful thinking, and we may still find it necessary to eliminate many weeds of misconception arising from long-lived seeds of prejudice or from those blown in by the strong winds of dogmatic assertion.

Many members of the society are engaged in teaching as well as in research. Theirs is a special obligation of providing for future progress in the attainment of higher standards of horticultural science by discovering specially gifted and promising individuals. They must see to it that these recruits are encouraged to become steeped in broad scholarship, and saturated with the spirit of inquiry, research and service that makes horticultural science significant. In emphasizing the need for thorough training in the fundamentals we are only propagating the ideals expressed by the founders of our organization, but we can now recognize more clearly than ever before that horticultural science may profit by a multitude of ideas, suggestions and experiences of many interdependent fields.

We may anticipate that the problems in horticulture will become increasingly difficult, since the public with whom we deal most closely has been educated to expect something more than a superficial insight. The modern concepts and explanations for horticultural problems may be better than the old, but we must acknowledge in all humility that they are still inadequate. It has been said of science in general that "the perfection of understanding toward which we are striving seems to grow more remote as it is approached" and again that "each scientific advancement only throws into clearer relief the mystery that remains." These statements apply with equal force to our field. The continuing need for something more comprehensive and more penetrating requires greater thoroughness than ever before in the development of skilled seekers after knowledge in our field.

The tasks of horticultural science, now grouped under floriculture and ornamental horticulture, vegetable gardening and pomology, will probably have to be divided still further to keep them within manageable units for effective attack. Such necessary specialization, however, needs to be accompanied by the broader vision afforded by a wider knowledge. The specialist must know "his stuff," but he must also know how to integrate what other branches of science may have to offer. He must know enough to appreciate the importance of contributions in the supporting fields, and his training in these subjects must be sufficient to enable him to distinguish between speculation and definite conclusions arrived at on the basis of facts. Consultation and cooperation with those in other fields will be more effective, and the advice given more to the point, if the problems can be stated intelligently in the technical language of the sciences concerned.

Presumably those whom we encourage to enter our field will have had some contact with the practical phases of horticulture. They will have made a creditable record as undergraduates not only in the courses dealing directly with the practical and economic relationships of their major subjects, but also in those dealing with general scholarship, and, of course, in the various supporting fields such as botany, genetics, soil science, plant pathology, entomology, bacteriology, physics, chemistry and mathematics. The horticultural scientist of the future will in all probability be greatly handicapped unless he knows more about some of these subjects than is generally required in good undergraduate courses. If he is to go beyond the point where he is likely to regard these sciences in more or less superstitious awe but can render only lip service as to their value for his particular field, he will need more advanced botany and genetics, more advanced chemistry, especially biochemistry, physical chemistry and micro-chemistry, and more advanced physics.

The student should not expect to find much in the advanced courses that is immediately or directly applicable to his chosen field, but he should acquire considerable mental satisfaction in knowing how one really discovers that things work more or less in accordance with some natural law and order. He will also derive lasting inspiration from knowing how to make use of these laws and methods in discovering still further secrets in his own field. Such training should help him to acquire skill in putting questions directly to nature in such a way that he can coax her into yielding answers that may be trusted within a minimum probable error. In addition, he stands to benefit enormously from the exacting discipline, the rigorous training in precise methods, accurate observations, clear thinking and critical inquiry that these subjects afford, especially in their more advanced stages.

The future horticultural scientist must understand that the experimental aspect of his investigation is something more than "mere puttering or blundering through." He must have originality based on an imaginative insight stimulated and controlled by contact with the older basic sciences. "Observation not guided by ideas is blind, just as ideas not tested by observation are empty."

To get far beyond the elementary stages of fact-gathering, the young horticulturist must be able to

approach the problems in his special field with methods characteristic of science in general. This involves among other things the intelligent use of refined instruments and mathematical tools of precision, to aid him in exact observations and fact finding. Such technique may be intelligently applied and appropriately modified for optimum use in the field of horticultural science only if the underlying principles as well as the limitations and the possibilities of these "aids to our infirmities" are understood.

In advocating a very thorough training of horticulturists in the underlying sciences, we are not unmindful that advances in our own field as well as in others may sometimes come about in an unexpected or an incidental manner, or even, in accordance with the laws of chance, as a result of hit-or-miss methods. By and large, however, only those whose training induces thoughtfulness and breeds well-balanced judgment and understanding are in a position to recognize that "they've got something there" if the unexpected or accidental happens. The greater the variety of fundamental subjects which the young horticultural scientist can effectively explore, the better his chances of greater accomplishments through either patient and systematical experiment or through so-called intuition or flashes of insight.

The motto of those whose duty it is to select recruits for our profession might well be: Let no one presume to enter the field of horticultural science unless he loves to work with plants and folks and has ability and the patience to acquire a thorough understanding of the basic and supporting sciences.

Such standing as our society has attained has been due in no small part to the ideals of scientific scholarship, fostered by our charter members, and carried forward by their pupils. We are especially honored in having as our guiding spirit and shining example the distinguished scientist and dean of American horticulture, Liberty Hyde Bailey. In a very real sense he has been the teacher of us all. As president during the first five years of its existence, he established the organization on a firm foundation, and helped to mold its policies for future usefulness. We are all grateful for his continuing and helpful interest in our meetings. Even though he has already passed the threescore years and ten allotted to the average man, his industry and enthusiasm for painstaking work might well tax the endurance of one half his age. His career as an inspiring teacher, an instructive and stimulating author, a helpful and sympathetic administrator of institutions and scientific organizations, and as a thorough, productive and untiring research scholar, will always serve as a challenge to workers in the field of horticultural science.

OBITUARY

GEORGE HENRY FALKINER NUTTALL

ON December 10, 1937, died in Cambridge, England, a scientific worker whose career was associated in significant fashion with an unusually large number of new scientific fields and of research activities in different countries. Nuttall was born in San Francisco on July 3, 1862. His father was a physician of standing; his sister Zelia Nuttall is widely known as an investigator of high rank in archeology. He was broadly educated at home and abroad, receiving the M.D. at California in 1884 and the Ph.D. at Göttingen in 1890. After four years on the medical faculty at Johns Hopkins and a little longer on the staff of the Hygienic Institute in Berlin, he went to Cambridge (Eng.) in 1899 as university lecturer, and was appointed in 1906 Quick professor of biology. There his research and writings in bacteriology, microbiology, entomology and transmission of disease led to the foundation and endowment of the Molteno Institute for Research in Parasitology, established in 1919; Nuttall was made its director and continued as such until he became emeritus professor in 1937.

Nuttall's work opened up new fields of importance in which at an early date he felt the need of journals to represent these growing activities and to publish the results of the work. Accordingly he established first the *Journal of Hygiene* (1901) and later as a supplement thereto *Parasitology* (1908); he edited both for many years. Firmly established, they now rank as leaders in these fields of research.

As an investigator Nuttall early won prominence in hygiene and the etiology of disease. Among the long series of his papers those on hygienic measures in relation to infectious diseases, on blood immunity and blood relationship, on the bacteriology of diphtheria, ticks, insects and disease, and canine piroplasmosis deserve especial mention as opening new and important lines of research in biology and medicine. They also show clearly his versatility and ability as a researcher. This pioneer work led to his appointment on many government commissions in the newly developing field of tropical diseases which opened up in the closing years of the last century and spread rapidly after 1900. His services were recognized both by various governments and by election to honorary membership in many academies and societies.

Nuttall often visited his native country, and here as elsewhere was warmly welcomed as counselor and lecturer. At various times he delivered the Herter lecture at Johns Hopkins, the Harvey lecture of the New

York Academy of Medicine, the Weir Mitchell lecture at Philadelphia, and other similar addresses. His last visit was arranged by the University of Illinois in December, 1926. By invitation he attended the fifth Philadelphia meeting of the American Association, addressed one of the evening general sessions, gave the annual public address before the Entomological Society of America and a special lecture for the American Society of Parasitology on piroplasms; in the last he paid tribute to the pioneer work in this field done in the United States. After the Philadelphia meetings he visited and lectured at several other places. At the University of Illinois he delivered the Gehrmann lecture on January 11, 1927, at the College of Medicine and a series of University and Graduate School lectures in Urbana during the next three days under the auspices of the department of zoology.

After his retirement Dr. Nuttall carried on his scientific work at his home in the country near Cambridge. His wife died several years ago. The last photograph received from him showed the family group, including grandchildren, gathered in the delightful garden of the home where he spent the closing years of his life.

HENRY B. WARD

RECENT DEATHS AND MEMORIALS

DR. GEORGE BIRD GRINNELL, naturalist, explorer, anthropologist and conservationist, died on April 11, in his eighty-ninth year.

DR. WALTER THOMAS TAGGART, professor emeritus of chemistry at the University of Pennsylvania, died on April 11 at the age of sixty-six years.

DR. BERTHA KAPLAN SPECTOR, research associate in medicine at the University of Chicago, known for her work in amebic dysentery, died on March 26 at the age of forty-one years.

THE death is announced of Dr. Gustav Jäger, professor of physics at the University of Vienna, and of Dr. Max Wien, professor of physics at the University of Jena.

DR. FELIX LENGFELD, of San Francisco, died on February 22. A correspondent writes: "Dr. Lengfeld received the degree of Ph.D. in chemistry for his work with Remsen at Johns Hopkins in 1888, and a little later spent eight or ten years in the University of Chicago with Nef and Stieglitz, having the rank of associate professor of chemistry. Shortly after the turn of the century his eye-sight failed him and he had to retire from active work. He was a man of remarkable mind and a fine sense of humor."

Nature reports the death of Sir Raymond Crawfurd, registrar of the Royal College of Physicians, London, known for his work on the history of medicine, on March 9, aged seventy-two years; of Major A. D. Lumb, of the Scientific and Technical Department of the Imperial Institute, known for his work on the geology and mineral survey of southern Nigeria and the Udi Okana coalfield; of A. Magnan, professor of animal mechanics applied to aviation in the Collège de France, aged fifty-seven years, and of Melville Hilton-Simpson, the distinguished traveler and ethnologist, on March 17, aged fifty-seven years.

A SERVICE to mark the one hundredth anniversary of the birth of John Shaw Billings, surgeon and librarian, was held at 8:30 P. M. on April 12 at the Hurd Memorial Hall of the Johns Hopkins Hospital. The commemoration services were sponsored by the Johns Hopkins Medical Society and the Johns Hopkins Medical History Club. Former Judge Henry D. Harlan, of the Baltimore Supreme Bench, presided. Those who spoke included: Lieutenant Colonel Edgar Erskine Hume, Medical Corps, U. S. A.; Dr. Alan M. Chesney, dean of the Medical School; Dr. Sanford V. Larkey, librarian of the William H. Welch Medical Library; Dr. Raymond Pearl, professor of biology in the School of Hygiene and Public Health, and H. M. Lydenberg, director of the New York Public Library.

SCIENTIFIC EVENTS

MEDICAL RESEARCH COMMITTEE FORMED BY NATIONAL RESEARCH COUNCIL OF CANADA

APPOINTMENT of a committee to study the organization of medical research in Canada has been made by the National Research Council. This action was taken on the recommendation of a nation-wide conference on medical research held in Ottawa four weeks ago, which was attended by representatives of all the medical schools, organizations and institutions concerned in medical research including the provincial departments of health, the Department of Pensions and National Health and the National Research Council. Sir Frederick Banting, discoverer of insulin and director of the department of medical research at the University of Toronto, has been named by the council as chairman of the new committee. Four *ex-officio* officers suggested by the conference and approved by the council are: the president of the National Research Council, the deputy minister of the Department of Pensions and National Health, the president of the Canadian Medical Association and the president of

the Royal College of Physicians and Surgeons of Canada.

To complete the personnel of the committee invitations have been extended to twelve distinguished members of the medical profession, each of whom has specialized knowledge in a particular field and all have a broad general training and comprehensive knowledge of Canada's requirements in medical research.

Those who have been invited to serve on this committee are: Dr. G. H. Ettinger, department of physiology and embryology, Faculty of Medicine, Queen's University, Kingston, Ont.; Dr. A. Grant Fleming, dean of the Faculty of Medicine and professor of public health, McGill University; Dr. J. E. Gondreau, director, Radium Institute, University of Montreal; Dr. Duncan Graham, head of the department of medicine, Banting Institute, University of Toronto;; Professor V. E. Henderson, secretary-treasurer, The Banting Research Foundation, Toronto, Ont.; Dr. Donald Mainland, professor of anatomy, Dalhousie University; Dr. C. L. Pierre Masson, professor of pathological anatomy, University of Montreal; Dr. J. C. Paterson, director of the pathological department, Regina General Hospital, Regina, Sask.; Dr. W. G. Penfield, professor of neurology and neurosurgery, McGill University; Dr. P. H. T. Thorlakson, professor of surgery, Faculty of Medicine, University of Manitoba; Dr. Arthur Vallée, professor of pathological anatomy and secretary of the Faculty of Medicine, Université Laval, Quebec.

In order to provide continuity and adaptability members will be appointed for terms of two, three or four years and will be eligible for reappointment for a further term.

Dr. T. H. Leggett will be succeeded in the office of president of the Canadian Medical Association in June, 1938, but in view of his intimate knowledge of the steps leading to the formation of the associate committee on medical research the council decided to request him to serve as an additional special member so that the committee might have the benefit of his wide experience.

It has been suggested by many members of the medical profession that the formation of this committee on medical research under the National Research Council might well be a first step towards the formation of a medical research council for Canada similar to that which exists in Great Britain. Commenting on this suggestion Major-General McNaughton, president of the National Research Council, speaking at the conference, said that "the National Research Council was approaching the problem of organization of medical research at present as a preliminary measure only. When a purely medical research council became necessary, there would be no opposition whatever from the National Research Council. In fact the National Research Council would give every assistance possible in order to help a movement that, in the opinion of the council, is very important for the welfare of the people of Canada."

The immediate purpose of the committee is defined in the terms of reference which are: (i) To receive suggestions for requirements in respect of medical research and in matters related thereto; (ii) To consider by whom the investigations required can best be carried out and to make proposals accordingly; (iii) To correlate the information when secured and to make it available to those concerned; (iv) To do such other things as the committee may deem advisable to promote medical research in Canada.

The conference agreed that the scope of the new committee's activities should not be limited to particular subjects but that it should be empowered to investigate the whole field of medical research in Canada. One of the first steps to be taken by the committee will be to make a survey of the work in progress at various centers to determine how the activities of the various institutions concerned may be developed to the best possible advantage.

A remarkable record of individual research achievements was revealed in the prepared statements presented at the conference, but the need of bringing the available information together through a central body which could then make it more readily accessible to all concerned, was stressed by nearly every speaker. The new committee undertakes its task with the full support and under the direct leadership of the medical profession as a whole in Canada. Results of far-reaching importance are expected in the planning and co-ordination of medical research that will be possible through this new committee. Better dissemination of information regarding the multitude of projects that are being carried on by skilled workers in the hospitals and laboratories of the Dominion will greatly enhance the opportunities of the research workers to make their efforts count.

CORRESPONDENT

CAMPAIGN FOR AN ADDITIONAL ENDOWMENT FOR THE NEW YORK HOSPITAL AND THE CORNELL UNIVERSITY MEDICAL SCHOOL

AN endowment of $17,000,000 to give the public the full benefit of all service possible in its present buildings and to enlarge its present program of research and teaching to utilize existing facilities to the utmost, is sought by the Society of The New York Hospital jointly with the Cornell University Medical College.

Henry G. Barbey, president of the Society of the New York Hospital and chairman of the Joint Ad-

ministrative Board of the two institutions, has made a statement to the alumni of the hospital and of the Cornell University Medical College in which he said that:

> No part of the $17,000,000 is to be used for additional plant. It will be spent so that our magnificent buildings, modern equipment and skilful, kindly staff may be utilized to prevent and relieve more of the city's suffering. We estimate that service can be given to a materially increased number of patients with a relatively small increase in capital investment.

The hospital is now being conducted at a minimum of expense and to the maximum of the facilities which its present funds have permitted it to open, but it feels an obligation to make available additional beds and specialized services for patients, at the same time enlarging its program of research and teaching which is conducted jointly with the Cornell University Medical College. A portion of the income from the $8,000,000 which it is proposed to allot to the hospital will be used to cover the present annual operating loss of approximately $1,000,000 occasioned by the free and partly free care of patients. It is planned that the income from the $9,000,000 sought for the Cornell University Medical College will be used to strengthen the pre-clinical departments engaged in teaching and research.

The present New York Hospital was built to "endure not less than 100 years." Its specifications provided for floors and services which were beyond what could be put into operation at the outset. There remain to be put into use two entire floors of the children's hospital, a floor of the psychiatry building, and additional medical pavilions for the "sick poor"; and there is also need for expansion and development of present service in the fields of neurology, diseases of the eye, ear, nose and throat and in the field of orthopedics.

The Board of Governors comprises the new Endowment Committee, with Mr. Barbey serving as chairman. Among its other officers are: Barklie Henry, *vice-president;* Augustine J. Smith, *secretary;* Bronson Winthrop, *treasurer,* Cornelius N. Bliss, John Hay Whitney, Vincent Astor, and others. The plan, which has the endorsement of the United Hospital Fund, of which The New York Hospital is a member, is to stabilize and make less dependent on current donations each year the hospital's three great channels of service to the public. These are the medical care of the sick, the teaching schools of medicine and nursing and research.

It is planned to endow four graduate fellowships with $80,000 each to be used as scholarships for graduate doctors whose work shows brilliant promise, but who lack funds to continue.

THE BROOKLYN BOTANIC GARDEN

THE twenty-seventh Annual Report of the Brooklyn Botanic Garden, for the year 1937, reports an addition to the endowment funds of $250,000. A portion of the income from this fund is specified to be used for research in plant pathology. The garden also received a bequest of $10,000 to be expended for gates, seats or other structures on the grounds.

The report notes the municipal, national and international aspects of the activities of the garden. The exchange of plants, seeds and publications and the trade services and bureau of information include about 160 botanic gardens, municipal and national governments and commercial concerns in more than 50 countries. The inter-library loans from the garden include 24 states of the Union, the District of Columbia, Canada and India. Herbarium loans have included ten states, the District of Columbia and one foreign country.

Service to schools includes all five boroughs of Greater New York. More than 3,700 teachers in 214 elementary and high schools were supplied with plant material for the instruction of more than 177,000 pupils; 350 potted plants were placed in classrooms, and 36,000 plants raised by members of Botanic Garden classes of adults and children were taken home. The year's attendance at classes exceeded 100,000.

Nearly forty radio broadcasts on plant life and on the garden are now given annually over WNYC and in cooperation with the Radio Garden Club over WOR. The fan mail from these talks includes thirty-nine states, from Maine to California and south to Texas as well as from Canada. California supplies the third largest number of correspondents, *viz.,* about a hundred and twenty-five.

One section of the report is devoted to research in progress, including disease resistance in plants; breeding a chestnut tree of timber-producing character and immune or resistant to the chestnut blight; the culture, nomenclature and pathology of Iris with special reference to varieties of Japanese Iris; and problems in systematic botany. The publications of technical and popular papers by members of the staff during the year include nearly 100 titles.

The report stresses the falling off of income during the past ten years, and the urgent need of not less than a million dollars additional endowment.

SCHENECTADY MEETING OF THE NEW YORK STATE SECTION OF THE AMERICAN PHYSICAL SOCIETY

PHYSICISTS from forty-nine communities in New York State, and some from contiguous sections outside the state, formally organized the New York State Sec-

tion of the American Physical Society during a recent meeting at Union College. Of the 150 who attended the sessions, 113 became charter members of the new association.

Among the subjects discussed were television, a possible new approach toward killing cancerous cells by means of low-voltage rays; a discussion of fundamental problems in aeronautical science; microscopic work under conditions where optical instruments can not be used and telescopic work in hazy weather conditions.

Dr. Peter I. Wold, professor of physics at Union College, who had been chairman of the committee on organization and arrangements during the past six months, was elected the first chairman of the association for a term of two years. The charter members adopted a constitution, with the sanction of the American Physical Society, which dedicates the section to the "advancement and diffusion of the knowledge of physics." Any physicist, whether teaching or in industrial work, and students of physics are eligible for membership. Other officers elected were: W. B. Rayton, of the Bausch and Lomb Optical Company of Rochester, *vice-chairman;* Paul R. Gleason, of Colgate University, *secretary;* G. H. Cameron, of Hamilton College, *treasurer;* they will also serve during their term of office on the executive committee, to which were elected: Mrs. Anna W. Pearsall, of Hamilton High School, and R. E. Burrough, of the Eastman Kodak Company, for four years, and R. C. Gibbs, of Cornell University, and Carleton A. Moose, of Milne High School (Albany), for two-year terms.

Among the demonstration exhibits following the reading of papers was the antiphonal organ, designed and built by John Bellamy Taylor, acoustic engineer of the General Electric Company and lecturer on acoustics at Union College. Other exhibits included a monomolecular film technique which is being used by Dr. Caryl P. Haskins and his staff in the Haskins Laboratory of Union College; spectrometer exhibits by the Spencer Lens Company; recent developments in street lighting by the General Electric Company; a recently completed Michelson Interferometer, built by David W. Mann, of Harvard University, and some rare early books on physics owned by Professor Mortimer F. Sayre and the Union College Library.

Dr. Irving Langmuir, associate director of the General Electric Research Laboratory, was the principal speaker at the dinner which concluded the meeting. Dr. Wold presided. Dr. R. C. Gibbs, as president of the Optical Society of America, spoke briefly on the great need for such organizations as the New York State Section of the American Physical Society. Other speakers included Dr. Haskins, research professor of biophysics at Union College; Dr. E. H. B. Bartelink, of the general engineering laboratory of the General Electric Company; Dr. H. P. Gage, of the Corning Glass Works; Dr. Paul E. Hemke, of Rensselaer Polytechnic Institute, and Dr. R. P. Johnson, of the General Electric Research Laboratory.

SCIENTIFIC NOTES AND NEWS

DR. GILBERT NEWTON LEWIS, dean of the College of Chemistry at the University of California, has been awarded the fifth Theodore William Richards Medal of the Northeastern Section of the American Chemical Society "for conspicuous achievement in chemistry." The medal, founded in 1930 to commemorate the work of Professor Richards, of Harvard University, will be presented to Dr. Lewis at a ceremony on May 13.

THE American Institute of Chemists has awarded its annual medal to Dr. Frederick G. Cottrell, consulting chemist, metallurgist and inventor, in recognition of "outstanding scientific achievements and for his service to the profession." The medal will be presented to him at the annual dinner of the institute on May 14 at the Claridge Hotel, Atlantic City.

DR. C. O. SWANSON, head of the department of milling industry at Kansas State College of Agriculture and Applied Science, has been awarded the Thomas Burr Osborne Medal by the American Association of Cereal Chemists. The presentation will be made at the annual convention of the association at the Netherland Plaza Hotel, Cincinnati, on the evening of May 25.

THE John Phillips Medal of the American College of Physicians, given "for an outstanding contribution in the field of internal medicine or its allied sciences," was presented on April 6 to Dr. Harry Goldblatt, professor of experimental pathology of the School of Medicine of Western Reserve University. The medal was awarded to Dr. Goldblatt in recognition of "the development of an important method for the production of experimental hypertension in animals; demonstrating the importance of disease of the blood vessels of the kidneys in the origin of high blood pressure, and for contributing successfully to our understanding of the essential type, the most common disabling condition encountered by the medical practice." It had previously been awarded to Dr. Oswald Theodore Avery, of the Rockefeller Institute, New York; Dr. William Bosworth Castle, of Harvard University; Dr. Leo Loeb, of Washington University; Dr. Henry Robert Murray Landis, of the University of Penn-

sylvania, and Dr. Richard E. Shope, of the Rockefeller Institute, Princeton, N. J.

DR. H. S. LANGFELD, of Princeton University, was elected president of the Society of Experimental Psychologists at its recent meeting held at the University of North Carolina. Princeton was selected as the place for the next meeting.

GEORGE BLUMENTHAL, president of Mount Sinai Hospital, announced his retirement at a dinner given in his honor on March 8 by the board of trustees of the hospital. He will be elected president emeritus and will remain a member of the board. The dinner was held at the Hotel Pierre, and a plaque, which will be placed in the entrance foyer of the hospital's main building on 100th Street and Fifth Avenue, was unveiled. The inscription reads: "Erected on the occasion of the eightieth birthday of George Blumenthal by his fellow trustees to record their grateful appreciation of his inspired leadership and unparalleled contribution to the development of this institution during forty-six years as trustee and twenty-seven years as president."

Nature states that at the annual general meeting of the Biochemical Society, London, held on March 11, a presentation was made by the society to Sir Arthur Harden, on the occasion of his retirement from the editorship of the *Biochemical Journal*. The presentation took the form of an inscribed salver, bearing the signatures of all those still living who have served on the committee of the society during the twenty-five years of Sir Arthur's editorship. In making the presentation on behalf of the society, the present chairman of the committee, Professor H. J. Channon, reviewed the early history of the *Biochemical Journal*.

DR. MORITZ VON ROHR, formerly associate professor of medical optics at the University of Jena and for the past forty-three years associated with Carl Zeiss, Jena, known for his optical work in the development of lenses for cameras, microscopes and spectacles, celebrated his seventieth birthday on April 4.

UNDER the auspices of the Council of Jewish Organizations of the United Palestine Appeal, well-known actors of the Jewish stage in America paid tribute to Professor Albert Einstein, who was the guest of honor at a special performance on April 7 at the Public Theater, New York City. Leading performers presented their most popular rôles, and a musical program combined traditional synagogue music with the music of modern Palestine.

OFFICERS elected at the annual meeting in New York City of the American Association of Physicians are: *President-elect*, Dr. O. H. Perry Pepper, University of Pennsylvania; *First vice-president*, Dr. James B. Herrick, of the University of Chicago; *Second vice-president*, Dr. Noble Wiley Jones, University of Oregon; *Third vice-president*, Dr. Charles T. Stone, Galveston, Texas. Dr. James H. Means, professor of clinical medicine at the Harvard Medical School, president of the New York meeting, was succeeded by Dr. William J. Kerr, who became president-elect last year at San Francisco.

ASSOCIATE PROFESSOR BENGT STRÖMGREN, of the Yerkes Observatory, University of Chicago, has been given leave of absence for one year to enable him to accept a professorship at the University of Copenhagen. Dr. Karl Wurm, of the Astrophysical Observatory at Potsdam, Germany, has been appointed visiting assistant professor at the Yerkes Observatory for one year. He will be engaged primarily in the study of molecular spectra in astronomical sources.

RICHARD V. SOUTHWELL, professor of engineering at Brasenose College, Oxford, has been appointed for the first half of the academic year 1938–39 professor of applied mechanics in the School of Graduate Engineering of Harvard University. In exchange, Dr. Jacob P. Den Hartog, associate professor at Harvard, will lecture at Oxford.

IT is reported in the *Bulletin* of the Institute of International Education that arrangements have been made for an exchange of postgraduate medical students between the Physiological Institute at the University of Kiel and the Medical School of the University of California. Dr. Gilbert S. Coltrin, graduate of the Medical School of the University of Rochester and recently assistant in medicine at the University of California Hospital, has been awarded a fellowship at the University of Kiel, and will spend six months' research at the Physiological Institute. In exchange, Dr. Gerhard A. Brecher, assistant in the institute, has received an appointment as resident assistant in medicine at the University of California Hospital in San Francisco for the same period.

AT the School of Medicine of Indiana University, Dr. Thurman B. Rice, professor of bacteriology and public health, has been made chairman of the newly established department of bacteriology and public health, and Dr. Frank Forry, professor of pathology, chairman of the newly established department of pathology.

DR. PAUL B. SEARS, professor of botany at the University of Oklahoma, has been appointed head of the department of botany at Oberlin College.

NORMAN L. MUNN, of George Peabody College for Teachers at Nashville, Tenn., has been appointed professor of psychology at Vanderbilt University.

MATTHEW W. STIRLING, chief of the Bureau of

American Ethnology of the Smithsonian Institution, has returned from a six-weeks' archeological survey of Mexico, visiting sites previously mentioned in archeological literature, but only superficially explored, which may contain keys to the prehistoric development of new world culture.

DR. DERRILL M. DANIEL, entomologist of the State Agricultural Experiment Station at Geneva, N. Y., has returned from California, where he spent several months at the Citrus Experiment Station, Riverside, studying methods of the biological control of insect pests. On his return trip he spent some time in Florida, Georgia, South Carolina and Washington, D. C., visiting state and federal entomological laboratories.

THE first Edward Jasper Goodwin Memorial Lecture will be delivered by Dr. Robert Andrews Millikan, director of the Norman Bridge Laboratory of Physics and chairman of the Executive Council of the California Institute of Technology, in the chapel of the Packer Collegiate Institute on the evening of April 20. Dr. Goodwin was principal of the Packer Collegiate Institute from 1908 to 1918. Dr. Millikan will speak on "Science as a Social Force."

DR. GEORGE DAVID BIRKHOFF, Perkins professor of mathematics and dean of the Faculty of Arts and Sciences of Harvard University, president of the American Association for the Advancement of Science, will lecture on April 18 at 8:15 P. M. before the Lancaster Branch of the American Association for the Advancement of Science. His subject will be "Mathematics in the College Curriculum."

DR. F. C. KOCH, professor of biochemistry at the University of Chicago, will deliver the seventh Harvey Society lecture of the current series at the New York Academy of Medicine on April 21. He will speak on "The Chemistry and Biology of Male Sex Hormones."

DR. MARIUS B. GREENE, director of the Research Department of the Post-Graduate Association of Regional Anesthesia, formerly sanitary consul of the Allied and Associated Armies, delivered a demonstration lecture on March 29 on "New Surgical Methods of Treatment for Peripheral Paralysis and Allied Conditions" before the staff of the Army Medical School and Center at the Walter Reed Hospital, Washington, D. C. The session was presided over by Brigadier-General Raymond F. Metcalfe, and the discussion was opened by Lieutenant-Colonel Joseph F. Gallagher.

M. H. A. NEWMAN, of St. John's College, Cambridge, spoke at a meeting of the Galois Institute of Mathematics, which was held at the American Museum of Natural History on April 9. His subject was "Infinite Numbers."

DR. NIELS BOHR, professor of physics at the University of Copenhagen, spoke during an international broadcast from Copenhagen on April 5. His subject was "International Science." The program was arranged as a tribute to Dr. Bohr on the twenty-fifth anniversary of the announcement of his atomic theory. The program included a description of the recently erected research institute, which was dedicated on the same day.

THE fiftieth anniversary of the founding of the Rittenhouse Astronomical Society of Philadelphia was celebrated on April 8 with a dinner at the Robert Morris Hotel. Dr. John H. Pitman, of the Sproul Observatory, president of the society, introduced Dr. Jonathan T. Rorer, head of the department of mathematics of the Wm. Penn High School, as toastmaster, who reviewed the history of the society. After brief remarks by Dr. John A. Miller, director emeritus of the Sproul Observatory, and Dr. John E. Bryan, late superintendent of schools of Camden, N. J., Dr. Harlow Shapley, director of the Harvard College Observatory, spoke on "Fifty Years of American Astronomy." The Rittenhouse Astronomical Society was founded by the late Edmund E. Read, Jr., of Camden, and was chartered on April 1, 1888, as the Camden Astronomical Society. On October 12, 1927, the name was changed, to honor David Rittenhouse, pioneer American astronomer.

THE southeastern section of the Mathematical Association of America and the Georgia Academy of Science held meetings at the Georgia School of Technology, Atlanta, on April 1 and 2. More than 200 mathematicians from seven southern states and a hundred scientific men from Georgia were present. Fifty-three papers were presented. Dr. F. D. Murnaghan, of the Johns Hopkins University, was the visiting speaker of both organizations. He spoke on "The Basic Ideas of Arithmetic and Algebra" and on "Finite Deformations of an Elastic Solid."

DISCUSSION

PREHISTORIC QUARRIES AND IMPLEMENTS OF PRE-AMERINDIAN ASPECT IN NEW MEXICO

IN the course of geologic field work in New Mexico during the past summer two prehistoric quarries were visited and at one of them artifacts of unexpected type were found.

Fermor S. Church, master in Los Alamos School, and John T. Hack, a graduate student in geology at Harvard, were engaged in field work in San Pedro

Parks, a mountain top having a flat surface of low relief lying between 9,600 and 10,600 feet in altitude, at the north end of the Nacimiento uplift in Rio Arriba Co., N. M. I visited their camp on an inspection trip, from July 31 to August 3, 1937. Large areas of this flat summit area are underlain by a fine white to pearl-gray chalcedony, varying in thickness from 1 to 20 feet. The area of this unusual rock, about 40 square miles, and its relation to the relatively smooth surface, obviously part of a peneplain, is of considerable importance in the geomorphology and the Tertiary geology of the region. It will be fully described in a geological article by Church and Hack.

In one of the most northerly areas of this rock on the brink overlooking the canyons that lead down to the village of Gallina about 7 miles distant, there is an area of ancient pits in the chalcedony covering about 10 acres. These quarries lie in Sec. 22, T.22N, R.1E. The pits are 1 to 5 feet deep and 2 to 10 feet across. Some are filled with broken pieces of the stone, others almost empty. Except for a hammerstone of quartzitic sandstone, obviously a pebble brought up from the canyons to the north, there were no recognizable tools or pieces having a consistent shape. Nor was a workshop or camp located, but our reconnaissance was so short that traces of such features may have escaped our notice.

The discovery of this bed of chalcedony reminded me that Dr. H. T. U. Smith had found such a rock as a layer in Cerro Pedernal, a mountain 20 miles to the east. It is part of one of the Tertiary basin deposits of the Abiquiu Quadrangle[1] which is preserved in the highland area by reason of the lava cap of Cerro Pedernal. E. C. Cabot had previously described to me an ancient quarry in this chalcedony, obviously the work of primitives. Remembering this, I asked him to guide me there, and on August 13 we spent two hours at the site in the company of Mrs. Cabot, Frank Perkins, C. S. Denny and Charles Stearns.

This quarry consists of pits which extend along the outcrop of the chalcedony on the southwest side of Cerro Pedernal in Sec. 4, T.22N, R.4E. The site is a steep hillside reached by a trail from the road that runs up from El Rito Canyon, a distance of 4 miles from the little town of Youngsville. The pits are filled with broken pieces of the chalcedony, and a talus of broken quarried fragments extends down the hillside for more than 100 feet. At the eastern end of the ancient pits is a new hole obviously the work of a white man in which the bed is well exposed. It is 8 feet thick and rests on unconsolidated sand. The bottom 4 inches is black and banded and the top 6 inches is weathered to a porous crumbly and cream-colored layer. In this layer, colorless, pink and yellow chalcedony occurs in more or less isolated masses. The main body of the chalcedony is almost free from joints and is a pearly white to gray. Blocks 1 to 2 feet across, free from joints, can be easily obtained. This is an unusually good material for the making of stone implements.

The chalcedony of Cerro Pedernal has been known for a long time, and without much question the Indians resident in the area at the time of the Spanish Conquest knew of it, and hence the Spanish name of the peak, "Flint Mountain." The flint was used by the Pueblos as recorded by Hibben.[2]

At the site of the quarries there are piles and masses of small chips such as would result from making the small implements and arrow-heads of the Pueblo type. The greater part of the fragments are, however, of large size. We collected from the talus below the quarries and from the floors of the quarries 27 implements whose aspect is quite unlike any stone implement or artifact of the Pueblo Culture. Some of the implements resemble certain Paleolithic, Mesolithic and early Neolithic implements of Europe. That they have a comparable age is not necessarily implied by this similarity in form. They are but little weathered, although some are lichen-covered and all have somewhat duller edges and smoother faces than freshly broken material, as if they had suffered slight solution. The rate of weathering at this locality may be slow, although the site lies at an elevation of about 8,500 feet in the woodland zone with juniper and piñon. For this locality we have as yet no criteria for judging antiquity on patination and weathering.

The collection has been deposited in the Peabody Museum, Harvard University, where it has been given numbers 37–120–10/9576 to 9502. Mr. D. W. Lockard, fresh from study of the Paleolithic of France, has been kind enough to look over the collection and to give the attributions of Table I. He assumes no responsibility for the statements in the text not attributed to him. The similarity in the form of the implements to European types is not intended to imply any genetic relationship.

The forms in this collection consist of 2 fist axes of Abbevillian types and 3 implements of indeterminate type though of similar size and of somewhat similar form. These forms may, of course, be the remnants of blocks from which flakes have been broken off, but

[1] H. T. U. Smith, "Tertiary Geology of the Abiquiu Quadrangle, N. M," *Jour. Geol.* (in press).

[2] Frank C. Hibben, *Univ. New Mex. Bull.* (Anthrop. Ser.) 2: 1, 15, Pl. V[a], 1937.

TABLE I

IMPLEMENTS FROM PREHISTORIC QUARRY ON CERRO PEDERNAL, RIO ARRIBA CO., N. M.

Form	Length cm	Breadth cm	Thickness cm	
Abbevillian	14	6.5	3	
"	15	9	4–4.5	Especially good type.
Levallois flakes.	11	7	1.5 at thick end.	
	12	6.5		
Axe (a)	15	7.5	4.5	
"	14	6	4	Roughly rectangular cross-section; one shows much use and has been re-chipped at later date.
"	13	6	4	
"	13	6	4	
"	13	6.5	4	
Axe with twist (b)	13	4.5	3	One end has offset and 30° twist in lateral axis.
	13	5	2.8	
Broken axe	9	6	4	Axe (a) type.
" "	9.5	6	3.5	Axe (b) type.
" "	9	6.5	3.5	Cross-section is lozenge-shaped; not quite (a) type.
" "	10.5	7	2.5	
" "	10	8	4.5	
" "	11	7.5	4.5	
" "	14	9	4	Shape rectangular; cross-section is lozenge-shaped; small break.
" "	6	10	3.5	Small piece of above type.
Points	12.5	6.5	2	More or less pointed.
"	13.5	6	1.7	Oval base and point at other end.
Axe (?)	15.5	6	3.5	Flat face on one side; crest on other.
Triangular scraper (?)	9.5	9×10	4	Worked on both faces from all sides.
Hammer stone	8	7	5	Basalt.

that two of them have a strict conformity to type, on Mr. Lockard's testimony, leads me to believe that they all are designed for use.

Two specimens, on Mr. Lockard's identification, are typical Levallois flakes with the characteristic faceted striking platform.

The foregoing are the types having a definitely Paleolithic aspect. Two or more of each type are present, and the range in size is small.

The remaining implements are mostly axes or picks. Of these, type (a) is represented by 5 specimens that are remarkably regular in size. Each is roughly rectangular in cross-section. One of them has a squarish end and has been much used as a maul. It also has been rechipped at a later date as shown by differences in patination between the older and newer surfaces. Mr. Lockard points out that these implements have a strong resemblance to Early Neolithic axes.

There are two axes of type (b). These forms may be variants of type (a), but the section is more lozenge-shaped. Each is offset slightly near one end, where the lateral axis is rotated 30° from that of the main part. This twist is very characteristic. If one should imagine that these implements were hafted by thrusting into a bone, their peculiar "twist" would be advantageous. Mr. Lockard notes that these implements have a general resemblance to Late Mesolithic and Early Neolithic picks (Campignian and Ertbölle).

Eight implements are listed as broken axes. Of these, one is of (a) type and one of (b) type. The others are larger and more generalized, with lozenge-shaped cross-section. They have, according to Mr. Lockard, a pseudo-Acheulean aspect, and the right angle breaks might be interpreted as the beginning of a preparation for striking off a Levallois flake. However, there is no evidence of the faceting characteristic of a Levallois striking platform. It seems more likely that they are the broken parts of crude chipped axes or hammers which lack the rectangular section and conformity in size of type (a).

The points are less distinctive than the other implements. They would fit into a collection from almost any hunting culture. They are, however, not Puebloan.

The remaining implements can not be interpreted, but the large size of the axe (?) and scraper (?) make them unlikely components of the Pueblo stone culture.

At the time of collection the first hypothesis that came to mind was that these were blanks roughed out at the quarry for transport to a more convenient locality for the manufacture of a final product. The data assembled show that there are several forms which are like implements of the early stone cultures of Europe. Why should the forms of blanks imitate implements of earlier cultures? Is it possible that these quarries were opened by pre-Amerindian peoples? The rejects and implements of these earlier quarrymen may have since furnished material for making the smaller tools of the later tribes. Such a hypothesis needs testing by excavation of the site, which would reveal many new facts and perhaps lead to an entirely new hypothesis. However, it should be realized that if the forms were produced by pre-Amerindians, it does not follow that they were contemporaneous with people who made similar tools in Europe. Nor is it necessary to conclude that successive waves of Abbevillian, Levallois and Mesolithic peoples inhabited the region. All that these finds seem to imply, in the present state of our knowledge, is that peoples of unknown character but having a different and apparently non-Pueblo stone culture, have lived in the area. Much recently acquired information leads to this same generalization and the Folsom[3] and cultures of similar age are well established. The fine chipping of these cultures is not here repeated. However, in the collection from Lake Mojave[4] there are large core and flake implements which are in many

[3] F. H. M. Roberts, *Smithson. Misc. Coll.*, 94: 4, 35 pp., 1935; *Idem.*, 95: 10, 38 pp., 1936. A. E. Jenks, *Amer. Anthrop. Assoc. Memoirs*, No. 49, 49 pp., 1937.

[4] E. W. and W. H. Campbell and others, *Southwest Museum Papers*, No. 11, 118 pp., 1937. See C. A. Amsden, Pl. xxviii, b, and c, pls. xxx, b, and xxi b.

respects comparable in size and type of workmanship to some of the forms of this collection. Many of the Lake Mojave implements, as is evident from the published plates, have been much modified by the cutting of wind-driven sand and their original form obscured. It would be premature to attempt a correlation by typology. Nevertheless, the existence of the Lake Majove types lends support to the hypothesis that the finds at Cerro Pedernal, are not blanks, but the implements of a hitherto unrecognized culture or cultures.

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VEGETATION ON SHELL MOUNDS, LOWER CALIFORNIA

THE interesting note by Hrdlička[1] on the distinctive plant life of native village sites in Alaska brings to mind parallel phenomena observed by the writer two thousand miles farther south on the Pacific coast.

The marine terraces which skirt the northwest coast of Lower California are dotted with shallow but extensive Indian shell middens. Near Pabellon Canyon (southeast of San Quintín), where the marine terrace zone is eleven miles wide and rises by gentle steps from sea level to 1,600 feet above sea level, a field survey was made across the entire terrace zone. Shell mounds were largest near the coast, but even along the six miles at the landward end of the survey line twenty shell middens were observed. On the average, each of these inland middens covers about an acre and is a foot and a half deep at the center. The deposits consist principally of ashes, broken clamshells and blackened rock chips.

The middens are covered with dense brush, of *Franseria chenopodiifolia* interspersed with California sagebrush. The surrounding terrace surface is either gravelly, with an open formation of agave and cactus, or a crumbly clay sparsely covered with low annuals, especially tarweed (*Hemizonia lobii*). The compactness, height and color of the *Franseria* thickets made it possible to discover middens from a considerable distance. In July, the dirty yellow-green of the thickets stood out in marked contrast to the grey-brown of the higher agave and the buff-yellow of the lower tarweed formations.

Accidental transportation of seed by Indians and favorable soil in the middens explain the dominance of *Franseria*. A small tenacious burr favors dissemination. Coastward, the plant grows abundantly on the silty lower terraces below a level of 800 feet, and Indians must have involuntarily accumulated many burrs as they returned inland from digging clams along the coast. *Franseria* also abounds on the silt floors of the deep canyons which traverse the terraces, and some burrs may have been picked up when the Indians brought water from the arroyos to their camps on the dry ridges along which ran their trails to the interior. Since the plant had no known economic value to the Indians, deliberate transportation is ruled out as a possibility. Once brought to the middens, the seeds thrive on the rich ashy soil, but do not grow on the surrounding gravel and clay.

Seaward from the 800-foot level, midden vegetation is distinguished by the fog-loving ice plant, *Mesembryanthemum crystallinum*. This plant flourishes not only on shell mounds but wherever else the soil has been recently disturbed: on abandoned roads and fields, disintegrating adobe mission walls, rodent diggings and recently eroded surfaces.

Twenty miles farther south, another detailed survey revealed similar relations between middens and vegetation on the ridges and canyons of the eroded marine terrace.

Expert comparative study of midden vegetation might throw light on such subjects as Indian routes and (through analysis of plant successions) the relative recency of abandonment of *rancherías* sites.

PEVERIL MEIGS, 3RD

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THE LEVEL OF THE OCEAN DURING PART OF THE CENOZOIC ERA

THREE problems of the Cenozoic Era are: (A) Submarine channels on the continental shelf; (B) several changes in climate, including a period of continental glaciation, and (C) intercontinental migration of land animals.

The submarine channels on the ocean side of the continental shelf of North America, both on the Atlantic and the Pacific side, show from the recent surveys extended consequent courses with deep narrow valleys of the canyon type. They have tributaries with branching angles of less than ninety degrees. The evidence is that they were formed by corrasion of running water.

A great lowering of the ocean level would give gravitational impulse to river water to accomplish this sculpturing.

Following the theory of the origin of nebulae by tidal disruption on the approach and close passing of two heavenly bodies, it is plausible to think of a minor heavenly body so passing the earth. This passing might well abstract surface water from the globe, including a large fraction of the volume of the oceans. Instead of a single approach there may have been a series.

The water so withdrawn would be lifted into the stratosphere and assume a configuration like the

[1] Aleš Hrdlička, SCIENCE, 86: 559–560, 1937.

gs of Saturn. The rings differ from those of turn in that they were not equatorial but their ter was in high northern latitude and their larger mension was parallel to the surface of the globe. e water was frozen.

These rings gradually disintegrated into a general udiness. The individual particles of ice fell upon e earth as salt hail. Continental glaciers of the leistocene would be made of this salt hail. The pious falls of hail would be due to causes outside e area of meteoric precipitation. Such salt ice uld melt at a lower temperature than fresh ice and ve a greater melt volume for a given amount of nsferred solar heat.

Incident to the salt content, glacial till would deliesce and assume from the practically fluid condion its characteristic flat surface. Salt outwash water d the rivers flooded with it would kill vegetation. e exposed bare soil would be taken up by the wind d deposited as the extensive deposits of loess.

On the return of the abstracted water the oceans uld regain their normal level and the present ocean rrents would be set up. Normal rain would wash e salt from the land and return it to the ocean. uring the abstraction the land bridges obtained.

A. H. FRETZ

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SOIL CORROSION

IN the present commendable movement toward the conservation of the nation's soil resources major emphasis is rightly being placed on the losses through the action of physical forces, that is, on the wastage of soil through erosion by wind and water. However, in some sections of the country soil deterioration through losses of soil organic matter, lime and plant nutrients caused by chemical actions is more important than that effected by the physical forces of erosion. The visible effect of soil degradation through chemical action is usually less spectacular than that caused by physical erosion, but it is not less real in respect to the productivity of the land. In New England, the Atlantic and Gulf Coastal Plains and other sections of the United States there are certain soil types which, on account of their high permeability, or methods of management, or both, suffer greater losses through chemical actions than by physical forces. Chemical actions which may cause soil deterioration include, among others, oxidation, hydration, carbonation and solution, all of which are, up to a certain point, helpful and desirable in the soil economy, but when unduly accelerated by certain practices or conditions are wasteful. It is in the interest of conservation in its broad interpretation to cause a reduction where possible in soil losses through chemical action and a replacement of unavoidable losses by the use of soil amendments. Soil deterioration or wastage through chemical action may be expressed by the word *corrosion,* in contrast with soil wastage by physical forces, or *erosion. Corrosion* is already in use by geologists to some extent to express virtually the same idea as that suggested.

A. B. BEAUMONT

SCIENTIFIC BOOKS

ANIMAL GEOGRAPHY

Ecological Animal Geography. By RICHARD HESSE, W. C. ALLEE and KARL P. SCHMIDT. New York: John Wiley and Sons, 1937, pp. xiv + 597. Price, $6.00.

ANIMAL geography has been a favorite subject for research and discussion for many years, but Hesse's "Tiergeographie auf oekologischer Grundlage," which was published in 1924, was the first serious attempt to apply ecological methods, principles and facts to the study of animal distribution on a world-wide scale. Previous neglect to apply such methods and principles to the problem was due in part to the scarcity of knowledge regarding animal ecology and in part to the fact that the literature was widely scattered and difficult to obtain.

The present work is not a mere translation of Hesse's original volume, but all parts of it have been thoroughly revised and brought up to date; this revision was made necessary by the great advances that have taken place in animal ecology since 1924. Much new material has also been added, and many American examples have been used to illustrate the various ecological problems that are discussed.

The book is divided into 28 chapters, of which several of the early ones (pages 1–145) are devoted to a discussion of general subjects, such as the problems and relations of ecological animal geography, the conditions of existence, the effect of environment on distribution, barriers, geographic isolation and biotopes and biocoenoses. The later chapters, arranged in three sections (pages 146–556), deal specifically with marine, fresh-water and terrestrial animal communities and the environmental factors which affect them.

In the section on marine animals, the various chapters deal with the physics and chemistry of ocean waters, the biotic divisions of the ocean and the geographic divisions of the pelagic communities of the sea; in the latter chapter the authors discuss the tropical and polar marine communities, especially of the plankton, in relation to the differences in physical environment.

In the fresh-water section the physical and chemical factors of the environment are presented, such as the temperature, heat budgets, light penetration and oxygen tension of lake waters. These are followed by a discussion of the animal communities of running and standing waters. In the latter attention is given to the various types of lakes as well as to the life of the different zones, such as the forms that live in the shallow water, on the bottom and in the limnetic region. The unique and interesting faunas of Lake Baikal and Tanganyika receive special mention. Running waters offer a different set of environmental conditions from standing waters, and their animal communities are correspondingly different in many respects.

The third section deals with the distribution of land animals, including the various kinds of communities such as those found on dry land, in forests, in swamps, on islands and in alpine, polar and subterranean environments. The final chapter considers some of the effects of man on the distribution of other animals; the effects of deforestation, cultivation of the land, intentional and unintentional transportation of animals, as well as the pollution and artificial modification of lakes and streams, are discussed in this connection.

The book is well written and the text is illustrated with 135 figures. Extensive bibliographies are given at the ends of the various chapters. It is a very welcome addition to the literature dealing with animal distribution from an ecological standpoint.

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BIFURCATION IN SERPENTS

Axial Bifurcation in Serpents. By BERT CUNNINGHAM. Duke University Press, Durham, N. C. 1–91, fig. 1, pls. i–xii. $2.50. 1938.

MOST herpetologists are aware that for many years past dicephaly in reptiles has been one of Professor Cunningham's interests. In the present volume he brings together all the reliable records of dichotomus snakes that he has accumulated, together with the results of his own examinations and x-ray studies of much of the existing material. Grouping this material principally into three sections—those exhibiting cephalic, anterior and posterior dichotomy, he proceeds to deal with it chronologically.

Some of the citations in the historical section are very entertaining, as for example: "Also this yeere (1349) in the countie of Oxforde, nigh unto a towne called Chippingnorton, there was found a serpent having two heads, and faces like women, one being shaped after the newe tyre of that time; another after the manner of Flinder-mouse or Batte" (p. 14).

It was a surprise to this reviewer to learn that for snakes as many as 170 to 225 cases of such monstrosities are on record. Rhyne's account in 1680 of Javan two-headed nakes (p. 14) should, however, surely be referred to some such species as *Cylindrophis rufus* or *Maticora intestinalis,* which carry their tails poised like a head and in some instances have them appropriately colored.

The whole work bears such evidence of care and thoroughness that reviewers will be hard put to it to find flaws in its presentation. One might point out that the "*Coluber natrix,* taken near Drakensburg" (p. 25), if the identification is correct, is not "probably South Africa" (whose mountains are spelt Drakensberg), but Drakensburg in Hanover, Germany, where *N. n. natrix* is a common species. Similarly, as *N. a. fasciata* does not occur in Nicaragua, there is something amiss.

The concluding chapter consists of a summary and discussion as to the causative factors of dichotomy. Dr. Cunningham rejects shock or sudden change of temperature as the probable cause, considering that additional embryonic discs on a single yolk, or multiple organization centers originating from different egg nuclei, are more likely to furnish the correct explanation.

A good index and an extensive bibliography are included. An index or appendix in the nature of a systematic catalogue with modern nomenclature would have been an asset, but Professor Cunningham has furnished reasons (p. 67) for its omission. Many of the 134 figures are excellent photographic reproductions of prints from early works.

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SPECIAL ARTICLES

THE RESPONSE OF THE MYASTHENIC STATE TO GUANIDINE HYDROCHLORIDE

DALE, Feldberg and Vogt[1] in 1936 demonstrated that acetylcholine is liberated when a motor nerve to a striated muscle is stimulated and concluded that acetylcholine is essential for the transmission of motor impulses. Loewi and Navratil[2] had previously shown that physostigmine inhibits the action of enzymes which are normally present in body fluids and which hydrolyze acetylcholine to choline and acetic acid.

[1] H. H. Dale, W. Feldberg and M. Vogt, *Jour. Physiol.,* 86: 353, 1936.

[2] O. Loewi and E. Navratil, *Pflug. Arch. f. d. gesamt. Physiol.,* 214: 678 and 689, 1926.

In view of these results the discovery that physostigmine or the more commonly used prostigmine[3] will promptly cause a temporary restoration of function to myasthenic muscles makes it appear that the disease myasthenia gravis involves some abnormality in the participation of acetylcholine in the transmission of motor impulses. There appear to be four possible causes for such an abnormality: (1) that the enzymes which destroy acetylcholine are present in excessive amounts; (2) that there is a complete failure to liberate acetylcholine at the myoneural junction; (3) that there is a formation of abnormally small amounts of acetylcholine; (4) that the muscles are insensitive to the action of the normal amount of acetylcholine liberated by a nerve and so fail to give a response.

The first two possibilities appear to be definitely untenable. Experimental studies[4,5] have failed to demonstrate any increased activity of choline esterases in persons with myasthenia gravis. Some acetylcholine must be liberated in the myasthenic state since physostigmine, which can not replace but merely prevents the destruction of acetylcholine temporarily restores normal function.

There is no experimental proof available for either of the two remaining possibilities. If there were a decreased production of or lack of sensitivity to acetylcholine, or a combination of these two factors physostigmine would lead to improved muscle activity. By inhibiting the destruction of acetylcholine sufficient amounts would be allowed to accumulate to restore a more normal response. Similarly, it is evident that under any of these three conditions an agent which would increase sensitivity to the action of acetylcholine would also serve to improve the functioning of myasthenic muscles.

Frank, Nothmann and Guttman[6] have reported that simple guanidine compounds greatly increase the sensitivity of striated muscles to the action of acetylcholine. Much work has been reported from this laboratory and others on the more general effect of guanidine compounds.[7,8,9] Large doses (150–200 milligrams per kilo) of guanidine hydrochloride administered to animals produce intoxication. An early and prominent feature of the effect produced by these doses is the production of fibrillary tremors and tonic contractions of skeletal muscles. Other toxic manifestations include hypermotility of the gastrointestinal tract, hypoglycemia and circulatory disturbances—changes which are compatible with increased parasympathetic activity. We have recently shown[10] that this latter group of symptoms, but not those produced in muscles, can be largely prevented by atropine. In view of these findings it seemed possible that doses of guanidine far below the toxic level might improve the function of myasthenic muscles without the production of undesirable symptoms or that if such symptoms did develop they could be controlled by atropine without losing the effect of guanidine on muscles.

We have recently treated two cases of myasthenia gravis with guanidine hydrochloride. Both patients showed a marked temporary improvement in muscle strength as measured by ergographic studies. In one we have studied the effect of guanidine administration in the absence of other medication for a period of about two weeks. We have found that the daily administration of from 6 to 10 milligrams per kilo of guanidine hydrochloride to this patient caused a prompt restoration of muscle function comparable in intensity to that which could be induced by prostigmine. The increased muscular strength was apparent within ten to thirty minutes. The improvement persisted for about eight hours following a single dose of guanidine as compared to about two hours after a dose of prostigmine. When this amount of guanidine was given in three divided doses at intervals of several hours a continuous condition of increased muscle strength could be maintained. The guanidine was administered either by vein or by mouth. Equal amounts were found to be approximately equally effective by the two routes. As would be expected the effect was produced more promptly when the drug was given intravenously than when it was taken by mouth. The patient remarked repeatedly on her feeling of increased strength, energy, and general well being. No other sensations were noted following oral doses of guanidine and only a transient tingling and numbness of the lips and fingers following the intravenous injection of the drug. No atropine has been given. No undesirable symptoms have resulted from the daily administration of these doses of guanidine for a period of two weeks.

Our results point to the fourth possibility suggested earlier—that there is a decreased sensitivity to the action of acetylcholine in myasthenic muscles. Guanidine in some way temporarily restores a more normal sensitivity. In view of the frequently demonstrated antagonism between the actions of calcium and guanidine compounds it is possible that guanidine exerts its action on muscles through changes in the effect of inorganic salts.

[3] M. Walker, *Lancet*, 1: 1200, 1934.
[4] A. M. Cooke and R. Passmore, *Quart. Jour. Med.*, n. s., 5: 21, 1936.
[5] H. H. Hyland, *Can. Med. Ass. Jour.*, 35: 372, 1936.
[6] E. Frank, M. Nothmann and E. Guttman, *Pflug. Arch. f. d. gesamt. Physiol.*, 201: 569, 1923.
[7] A. S. Minot and J. T. Cutler, *Jour. Clin. Invest.*, 6: 369, 1928.
[8] A. S. Minot, *Jour. Pharm. and Exp. Therap.*, 43: 295, 1931.
[9] E. Frank, R. Stern and M. Nothmann, *Zeit. f. d. ges. Exper. Med.*, 24: 341, 1921.
[10] A. S. Minot. Paper in preparation.

In conclusion the administration of guanidine to persons with myasthenia gravis appears to be a rational procedure. In our brief experience guanidine has caused a marked improvement in muscle strength without the production of any untoward symptoms in a patient with the disease. We have been able to maintain a more even level of improved function than was possible with prostigmine. Further experience with the use of this drug will show whether the use of guanidine is any real advance in the treatment of myasthenia gravis.

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THE EXISTENCE OF MERCERIZED CELLULOSE AND ITS ORIENTATION IN HALICYSTIS AS INDICATED BY X-RAY DIFFRACTION ANALYSIS

WHILE making an x-ray study of the large, single-celled, marine plant, *Halicystis,* the presence of mercerized cellulose and certain unusual features regarding its orientation were found, a preliminary report of which would seem of interest prior to the publication of a more extended investigation pending the collection of fresh material next summer.

There are two polymorphic crystalline forms of cellulose (native and mercerized) which may be distinguished by their x-ray diagrams. In the native form, cellulose gives three principal x-ray diffraction rings corresponding to interplanar spacings of 6.1, 5.4 and 3.95 Å. If cellulose is regenerated from solution or liberated from its compounds with sodium hydroxide or certain other strong-swelling reagents, the native spacings are replaced by new spacings of 7.4, 4.45 and 4.0 Å. These latter spacings are associated with the hydrated or mercerized form.

The 7.4, 4.45 and 4.0 Å lines, and also three other outer lines characteristic of mercerized cellulose, may be identified in the x-ray diagram of *Halicystis.* There is also present a line not associated with cellulose, corresponding to the approximate spacing of 12.5 Å.

All samples of plant cellulosic membranes heretofore subjected to x-ray diffraction analysis show the cellulose to exist in the native form. For this reason the existence of diffraction rings in *Halicystis* corresponding to those of the mercerized form is of special interest. Whether or not this mercerized condition is specific for *Halicystis* is not known, since comparatively few of the lower plant membranes, or membrane constituents other than cellulose, have been subjected to x-ray analysis. The mercerized cellulose pattern was identified in three species of *Halicystis* (*grandis, ovalis* and *Osterhoutii*) obtained from different localities.

The orientation of cellulose in *Halicystis* is also unusual. With the x-ray beam perpendicular to the membrane surface, the 7.4 Å line is missing, and the 4.45 and 4.0 Å lines give a random oriented pattern; with the beam parallel, the 7.4 Å line is present as two arcs. This indicates that at any particular point in the membrane the 7.4 Å crystallographic planes are oriented parallel to the membrane surface, while the *b* axes of the crystallites (*i.e.,* the direction of cellulose chains) have a random orientation in the plane of the membrane. The non-cellulosic material has an orientation similar to that of the cellulose, as indicated by the fact that the 12.5 Å line is absent with the x-ray beam perpendicular, and present as two arcs when the beam is parallel to the membrane.

The structure of *Halicystis* is of special interest when compared with that of the similar, single-celled marine plant, *Valonia,* which has been the subject of considerable x-ray work.[1] The x-ray pattern of *Valonia* is that of native cellulose. Furthermore, the 6.10 Å crystallographic planes of *Valonia* are oriented parallel to the membrane surface (similar to *Halicystis*), while the *b* axes are oriented parallel in two sets which make an angle of approximately 80° to each other in the plane of the membrane (unlike *Halicystis*).

The present x-ray work was carried out in conjunction with the microscopic and microchemical studies of Farr[2] on the same samples.

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WATER-SOLUBLE DERIVATIVES OF P-AMINOBENZENE-SULFONAMIDE (SULFANILAMIDE)

THE low water-solubility of sulfanilamide suggested that related compounds of greater solubility might be of higher therapeutic efficiency because they would be absorbed and circulated more quickly; thus smaller doses could be administered.

For the purpose of this study a series of sulfonic acid compounds of p-aminobenzene-sulfonamide were prepared.[1] In the present work only those compounds

[1] Sponsler, *Nature,* 125: 633, 1930; *Protoplasma,* 12: 241, 1931; Astbury, Marwick and Bernal, *Proc. Roy. Soc. London,* 109B: 443, 1932; Preston and Astbury, *Proc. Roy. Soc. London,* 122B: 76, 1937.

[2] W. K. Farr, Paper presented before the Physiological Section of the American Association for the Advancement of Science at the Indianapolis meeting, December 28, 1937.

[1] This synthesis was carried out by the Laboratories of The Farastan Company, Philadelphia, Pennsylvania.

having a solubility in water greater than 1 in 20 were considered. They are shown in the accompanying table.

Compound	Solubility in H_2O at 25° C.	Per cent. of sulfanilamide in molecule	Toxicity for albino rats in milligrams per kilo of body weight
Sulfanilamide	1 in 200	100	7,040
Camphorsulfonate ..	1 in 2	42.5	6,240
Benzenesulfonate ...	1 in 14	49.4	5,400
Phenolsulfonate	1 in 14	49.7	7,040
Sulfosalicylate	1 in 16	44.1	6,000

The toxicity of these water-soluble compounds as determined by oral administration to albino rats is indicated in the table. The probable dose which would kill 50 per cent. of the animals fed is above the amount indicated.

It will be noted from the table that the toxicity of some of the soluble compounds is slightly greater than that of sulfanilamide. This may be due to the fact that the relatively insoluble sulfanilamide is not absorbed as readily as these compounds.

In the preliminary protective tests it was possible to demonstrate a protective action of the water-soluble derivatives equal to or greater than that of sulfanilamide, although the derivatives contain only 40 to 50 per cent. of the mother substance (sulfanilamide). The protective tests were performed on albino rats which had been infected intraperitoneally with lethal doses of beta-hemolytic streptococci of Lancefield's group A, and then treated by oral administration with the compounds studied. Three hundred and fifty animals were used in these tests.

The protective action of the most soluble of the compounds listed (camphorsulfonate) was not due to the camphorsulfonic acid radical alone, since this failed to protect rats when it was administered in equivalent doses. This material apparently had slight bactericidal effect on the strain of streptococcus used when tests were performed in vitro. This bactericidal effect was entirely lost, however, when the material was combined with the mother substance to form the camphorsulfonate compound.

Clinical studies and further animal experiments are now in progress and will be reported in the near future.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

SUSTAINING LONGITUDINAL VIBRATIONS IN RODS

THE well-known demonstration of the Bernoulli effect, in which a card can not be blown from the end of a spool, has suggested a means of maintaining longitudinal vibrations in a rod such as that employed in the Kundt tube experiment.

If the card is replaced by the smoothly squared end of the rod, the latter may be kept vibrating indefinitely by a stream of compressed air. It may be necessary to start the vibrations in the rod in the usual way by stroking by hand. Then, a little adjustment of the clearance between the end of the spool and the end of the rod and also of the air pressure will very easily secure vibrations of such large amplitude that the intensity of the sound produced is quite surprising. In so far as the writer knows, this method of sustaining longitudinal vibrations in rods has not been described previously.

This method has some distinct advantages over the standard mechanical, electromagnetic, electrostatic, magnetostriction and piezoelectric methods. It requires only the simplest of apparatus, little or no attention during operation, and it is applicable to rods (and other bodies) of many shapes.

Inasmuch as the pitch of the tone produced depends on the physical constants of the rod, a considerable variation in the air pressure is permissible. Ordinarily the writer has used a line pressure of about fifty pounds per square inch when working with a one-inch metal rod about six feet long. The hissing of the escaping air is quite unobjectionable, but if it is desirable to eliminate this sound entirely, the free end of the rod may be passed through a hole in the wall so as to serve as a source of sound in an adjacent room.

A rod vibrated by the method described here is ideal for the production of the Kundt dust figures or for setting up stationary waves in a large room. These may be detected by merely walking across the room.

If the end of the rod is replaced by the bottom of a "tin" can, such violent vibrations may be set up as to be deafening. In the same way a tuning fork may be operated continuously if the lateral face of one of the prongs is placed against the air jet. The sound thus produced may reach an intensity difficult to obtain otherwise.

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DISCOLORED PLATES

IN the Smithsonian Contributions to Knowledge, Volume VII, is an article by J. W. Bailey, "Notes

on New Species and Localities of Microscopical Organisms," published in February, 1854. It is illustrated by a plate printed on highly surfaced paper. This plate, in all the copies examined, had become so discolored that many of the figures could not be observed in any detail. Figures of diatoms are of great importance, especially in the case of new species. In an effort to clear up one of these plates, I tried the following treatment. Several sheets of newsprint were placed below the plate to absorb excess moisture. A small piece of absorbent cotton was dipped in hydrogen peroxide and with this the surface of the plate was gently swabbed, using no pressure. The swabbing was continued until no trace of the discoloration remained, after which the remaining moisture was removed with a clean white blotter. The plate was allowed to dry thoroughly and no alteration has taken place in three months since it was treated. The figures are restored to their original clarity.

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PRESENCE OF HOST KEEPS PARASITES ALIVE IN CAPTIVITY

FOR the past two years the Division of Entomology of the Agricultural Experiment Station at Rio Piedras, Puerto Rico, has been engaged in attempting to introduce and establish in Puerto Rico a parasitic wasp, *Larra americana* Saussure, which attacks the "changa" or Puerto Rican mole-cricket, *Scapteriscus vicinus* Scudder. The wasp occurs in considerable abundance at Belem, Pará, Brazil, at some seasons of the year, and because the adults could be collected so easily and by airplane transportation arrive in San Juan by the second morning, the attempt at introduction has up to the present been concentrated on the adults. Most unfortunately, however, the mortality of the wasps in captivity has been rather considerable, so that, under the best methods of shipment that could be devised, the bulk of them arrived at destination dead. To obviate this distressing mortality, the collector at Belem this year, Mr. Luis F. Martorell, has been inducing parasitism in the laboratory on collected mole-crickets and shipping parasitized changas in a screened container inside the larger box containing the wasps.

The difference in mortality is most striking. In the first two shipments made without changas, only one wasp arrived alive. In three succeeding shipments immediately following, accompanied by parasitized mole-crickets, nearly two thirds of the wasps were alive in the first, only one was dead in the second and two had been crushed under the box of soil and changas in the third. So far as one could judge, all conditions were the same for all shipments, except that two were without and three were with a screened cage containing parasitized mole-crickets. The presence of clean, moist soil, uncontaminated with changa feces, apparently is of no importance in this connection, as had been indicated in shipments containing much larger quantities of soil in preceding years. It should be especially noted that the wasps could not come into actual physical contact with the changas because of the screen covering the box or can containing the earth inhabited by the mole-crickets; thus they could derive no satisfaction in again attempting to parasitize them, and the wasps do not feed upon the changa, for it is the egg and the larva of the wasp which is parasitic, not the adult. The excrement of the mole-crickets is a black foul-smelling liquid, and when many of them are crowded close together, its odor is powerful. The crickets also chirp and sing, this being another possible comfort to the wasps in captivity, besides being an obvious proof of their hosts still being alive. No attempt will be made to determine whether the smell of or hearing their host is the more powerful in inducing *Larra* wasps to endure the discomforts of captivity, because the value of each shipment is too great to permit of experimentation once a successful method of shipment has been found. But this appears to be the first instance of the mere presence of the host serving to keep introduced parasites alive while en route between the point of collection and that of release. A more detailed account of the entire project is to be published in the *Journal of Agriculture* of the University of Puerto Rico.

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